

**EFFECTS OF CERTAIN FUNGICIDES ON LEAF INFECTION,  
YIELD AND QUALITY OF CANTALOUPE INFECTED BY  
*SPHAEROTHECA FULIGINEA*<sup>1</sup>**

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*ABSTRACT*

Triarimol 4% WP at 10, 20 and 30 ppm (active material), benomyl 50% WP at 500 ppm (active material) and sulfur 95% WP at 0.3% were compared on cantaloupe cultivar Shahd-e-Shiraz on a 14-day spray interval under field conditions for the control of powdery mildew, *Sphaerotheca fuliginea* (Schlecht.) Poll. The degree of leaf infection, fruit weight and number and soluble solid content of the fruits were evaluated.

All chemical treatments reduced leaf infection and were significantly better than controls. Triarimol at a concentration of 10 ppm was significantly superior to benomyl and sulfur for disease control. No significant increase in yield (weight and number of marketable fruits) and soluble solid content of the fruit was obtained by the treatments.

When different concentrations of triarimol were compared on a 14-day and a 21-day spray intervals, it was found that the 10 ppm at 14-day interval was significantly better than the 30 ppm on 21-day schedule on reducing leaf infection.

*INTRODUCTION*

Cantaloupe (*Cucumis melo* L. var. *reticulatus* Naud.) is an important crop among cucurbits in Iran. Most of the common varieties suffer from powdery mildew caused by *Sphaerotheca fuliginea* (Schlecht.) Poll. The severity of the disease is affected by factors such as varietal susceptibility and environmental conditions.

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There is scanty information on the effects of fungicides on leaf protection against the powdery mildew fungus and its influence on yield and soluble solid content of the fruits. There are many reports, however, on the effects of chemicals for control of powdery mildew on leaves. Sulfur dust or spray has been commonly used in controlling powdery mildew of cucurbits. Because cucurbits are sensitive to sulfur, however, various attempts have been made to develop sulfur resistant varieties such as V-1 and SR-90 (9). Attempts have also been made to develop fungicides other than sulfur to control powdery mildew disease in cucurbits (1, 4, 6, 7, 8, 10, 11, 12, 13). Methyl -1 (butylcarbomyl) -2- benzimidazolecarbamate (benomyl), a systemic fungicide, has been reported to reduce leaf infection by the powdery mildew fungus on muskmelon under field conditions (8, 10, 11). There are reports that several applications of benomyl to *S. fuliginea* resulted in the development of resistant isolates of the fungus (12). It was assumed that either such isolates were Benlate dependent or the chemical interfered with plant tolerance to powdery mildew.

Triarimol,  $\alpha$ -(2, 4-dichlorophenyl)- $\alpha$ -phenyl-5- pyrimidinemethanol, a newly developed systemic fungicide, has been reported to control powdery mildew of cucurbits (1,4,6) and other diseases (2,3,4,5,6). The fungicide is reported to be both eradivative and protective (2,3,6). Our previous study (1) on *S. fuliginea* on cucumber showed that triarimol at 20 ppm (active material) was superior to sulfur spray (0.3%) with respect to the reduction of leaf infection and yield increase.

The purpose of this investigation was to evaluate the fungicidal properties of triarimol on *S. fuliginea* on cantaloup and to compare it with some recommended fungicides such as sulfur and benomyl under field conditions. The effects were measured in terms of the degree of leaf infection, yield (fruit weight and number), and also soluble solid content of the fruits.

#### MATERIALS AND METHODS

The experimental plots were located at the College of Agriculture Experiment Station, Pahlavi University, about 15 km north of Shiraz. The soil was silty clay with pH 8.8.2.

Two experiments were carried out during the two successive summers of 1970 and 1971. In both cases seeds of cantaloup cultivar Shahd-e-Shiraz were sown in the first week of May. All field operations were done as reported earlier (1).

In the 1970 experiment, between every two plots, three rows were used as paired control and also as source of inoculum throughout the field. In the 1971 experiment, between every two plots including controls and also along the field border, rows were planted on both sides of the beds and served only as a source of inoculum. By the above-mentioned practice, even distribution of inoculum could be obtained throughout the field during the course of the experiment.

A randomized complete block design with four replications (each consisting of three 15m rows, each row with 15 plants) was used in both years. In 1970, the treatments consisted of triarimol (EL-273) 4% WP at the rate of 10, 20 and 30 ppm active material sprayed at 14-day and 21-day intervals, benomyl (Benlate) 50% WP at the rate of 500 ppm active material, sulfur 95% WP at the rate of 0.3% and control (non-sprayed) were employed on 14-day schedule. No additives were used with the fungicides. Applications were made with a knap sack sprayer from 6 to 10 in the morning. Plants were sprayed to the run-off stage. The first spray was started on July 4 in the 1970 experiment and on July 13 in the 1971 experiment, when the first powdery mildew spots were detected on the lower leaf surfaces. Four applications were made when the spray interval was 14 days and 3 when the interval was 21 days.

Disease rating was done on August 13 and 20 in 1970 and August 17 and September 1 in 1971. Powdery mildew infection was assessed on a 0-10 rating system (1). All mature fruits of individual plants were harvested from July 30 to September 2 and numbers and weights were recorded. Soluble solid content of each fruit was measured by a hand refractometer using a few drops of the pulp juice. Fruit samples of triarimol treated (10 and 30 ppm, 14-day schedule) and non-sprayed controls were harvested at various times after applications and were cooled to 4 C and sent in insulated boxes by air mail to the Lilly Research Center, Surrey, England, for residual analysis.

## RESULTS

*Results of 1970:* On the basis of August 13 rating, triarimol used at 10 ppm on a 14-day schedule was significantly (1% level) superior to 30 ppm used at a 21-day interval in respect to disease control (Table 1). No significant differences were obtained among concentrations in each interval, however.

Triarimol, benomyl and sulfur on a 14-day schedule significantly reduced leaf infection and were below controls (water-sprayed and non-sprayed plants). Triarimol at 10 ppm

Table 1. Effects of various chemical treatments on leaf infection of cantaloupe by *Sphaerotheca fuliginea* under field conditions, 1970.

Treatments	Dosage	Disease rating <sup>a</sup>	
		August 13	August 20
Triarimol 4% WP <sup>b</sup>	10 ppm	4.12 b*	5.05 b
"	20 ppm	3.15 b	3.35 bc
"	30 ppm	3.82 b	4.12 bc
Triarimol 4% WP <sup>c</sup>	10 ppm	0.87 c	1.59 cd
"	20 ppm	0.67 c	1.42 cd
"	30 ppm	0.22 c	0.17 d
Benomyl 50% WP <sup>c</sup>	500 ppm	0.12 b	3.96 bc
Sulfur 95% WP <sup>c</sup>	0.3%	2.95 b	4.75 b
Water <sup>c</sup>	—	9.67 a	9.77 a
Control	—	9.80 a	9.75 a

<sup>a</sup>Disease rating: 0 = no spots, 10 = total leaf destruction.

<sup>b</sup>21-day spray interval.

<sup>c</sup>14-day spray interval.

\*Means in each column followed by the same letter are not significantly different at the 1% level (Duncan's test).

was significantly superior to either benomyl or sulfur on both dates (August 13 and 20), but no significant difference was obtained between benomyl and sulfur in this experiment.

None of the treatments significantly increased the fruit weight and number or soluble solid content of the fruits (Table 2). Residue in samples taken two days after application of triarimol at 10 and 30 ppm was quite low (0.005–0.006 ppm).

*Results of 1971:* All treatments reduced leaf infection significantly below controls. Triarimol at 20 and 30 ppm was significantly superior to sulfur (Table 3). From August 17 to September 7, disease severity in sulfur-treated and control plants increased, whereas in the triarimol treated plants there was no sign of disease increase. Because of great fruit loss from decay caused by *Phytophthora*, *Pythium* and insect damage, no yield data could be obtained on the 1971 experiment.

#### DISCUSSION

The results of this investigation indicate that although all the selected fungicidal treatments reduced leaf infection significantly, application of triarimol at 10 ppm or higher at a 14-day interval was superior to benomyl and sulfur. Triarimol at a 21-day spray interval however, was less effective than at 14-day interval, but did not differ significantly from either benomyl or sulfur at a 14-day interval. Very few spots of powdery mildew could be detected on the plants treated with triarimol on a 14-day spray schedule, whereas sulfur or benomyl-treated plants usually contained numerous spots on both sides of the leaves.

Most of the available information on fungicidal effects of various chemicals on powdery mildew in cucurbits are based on disease ratings rather than yield data. In the present study, despite excellent disease control on the leaves, no significant increase in yield and soluble solid content of the fruits could be obtained among treatments. Several possible explanations may be advanced for the above-mentioned discrepancies. The lateness of initial infection and rate of disease development before harvest might have had some influence on yield. The first spots of powdery mildew were noticed when plants were about 60 days old and possessed a considerable number of large green fruits. The second explanation is the failure of a great number of green fruits to mature on treated plants due to the unfavorable environmental conditions prevailing near the end of the growing season. At this time triarimol-treated plants with excellent vigor, possessed con-

Table 2. Effect of various chemical treatments on fruit weight and number and soluble solid content of cantaloup infected with *Sphaerotheca fuliginea* under field conditions, 1970.

Treatments	Dosage	Fruit wt., g/plant	No. Fruit/ Plant	Soluble solid/ fruit, %
Triarimol 4% WP <sup>a</sup>	10 ppm	1909	1.80	9.13
"	20 ppm	2019	2.03	8.76
"	30 ppm	2014	2.14	9.46
Triarimol 4% WPb	10 ppm	2028	1.81	9.42
"	20 ppm	2161	2.03	9.17
"	30 ppm	1938	1.91	8.99
Benomyl 50% WPb	500 ppm	1941	2.00	9.02
Sulfur 95% WPb	0.3%	2229	2.17	9.23
Water <sup>b</sup>	—	1726	1.82	8.04
Control	—	1696	1.77	8.47

<sup>a</sup> 21-day spray interval.

<sup>b</sup> 14-day spray interval.

Table 3. Effects of triarimol and sulfur on cantaloup powdery mildew, *Sphaerotheca fuliginea*, under field condition, 1971.

Treatments <sup>a</sup>	Dosage	Disease rating <sup>b</sup>	
		August 17	September 7
Triarimol 4% WP	20 ppm	0.75 c *	0.25 c
"	30 ppm	0.42 c	0.32 c
Sulfur 95% WP	0.3%	2.07 b	5.75 b
Control	—	6.12 a	9.67 a

<sup>a</sup>All sprayings were done on a 14-day interval.

<sup>b</sup>Disease rating: 0 = no spot, 10 = total leaf destruction.

\* Average of 40 plants. Means in each column followed by the same letter are not significantly different at the 1% level (Duncan's test).

siderable numbers of green fruits which were not taken into account. According to our previous report (1), significant yield increase in triarimol-treated cucumber was obtained when the experiment was extended to the point that control plants showed severe infection resulting in the differentiation among the treatments. In that case, however, all fruits were harvested.

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